An Overview of Treatment Methods for Arsenic Removal from Drinking Water

By
Dennis A. Clifford, Ph.E., P.E.
University of Houston

As a result of the new 10 μg/L MCL for arsenic, more than 3,000 community water supplies in the USA will have to provide treatment to remove arsenic or seek alternative sources. Most of these are small communities that rely on ground water. The treatment technologies that have been used to remove arsenic from drinking water are conventional iron and alum coagulation, coagulation filtration (C-F), coagulation microfiltration C-MF), ion exchange, adsorption onto granular aluminum and iron oxides, lime softening, nanofiltration (NF), and reverse osmosis (RO) hyperfiltration. Of these processes, only adsorption onto granular aluminum and iron oxides, ion exchange, C-F, and C-MF are considered applicable to small community water supply treatment, and these processes are described in some detail. For all the processes operated in the pH range of 6-9, the oxidized form of arsenic, arsenate or As(V), is better removed than is the reduced form, arsenite or As(III). Furthermore, As(III) is much more acutely toxic compared with As(V). For these reasons, oxidation is often used as a pretreatment step for waters containing As(III). In this regard, chlorine, permanganate, ozone, and solid oxidizing media (manganese oxides) have proven very effective, whereas, chlorine dioxide, monochloramine, and UV alone were not effective.

The pH of the water and the background contaminants including TDS, silica, phosphate, sulfate, and other ions can significantly influence the effectiveness of a particular treatment process. Thus, the effects of the background contaminants, will be discussed in addition to design issues such as safety, process complexity, residuals disposal, and use of hazardous chemicals.